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B4C C6C

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(54) Abstract Title
Hand tool machine with tool shank lubrication

(57) In a hand tool machine having a rotary and/or percussive tool motion, a drilling or impact hammer, the tool holder (10), has a location opening (12) for insertion of an insertion end (33) of a tool shank (13). Means of lubricating the tool shank (13) inserted or to be inserted into the location opening (12) is provided by a lubricant store 27.

With the aid of the lubrication, the wear of tool holder and insertion end may be substantially reduced.

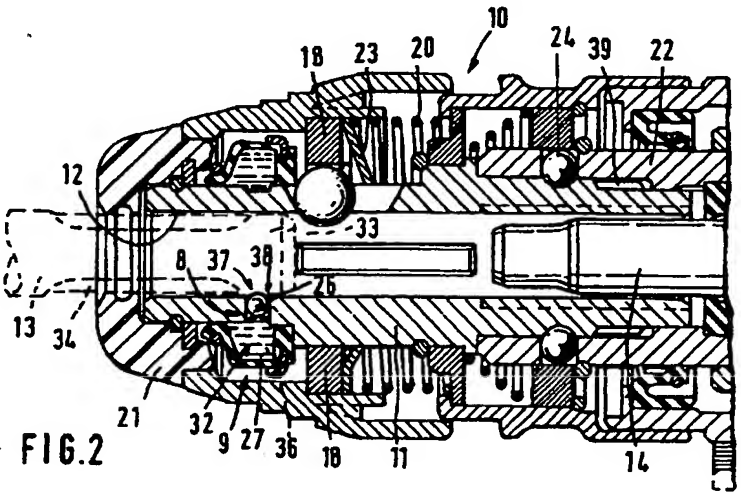

FIG.2

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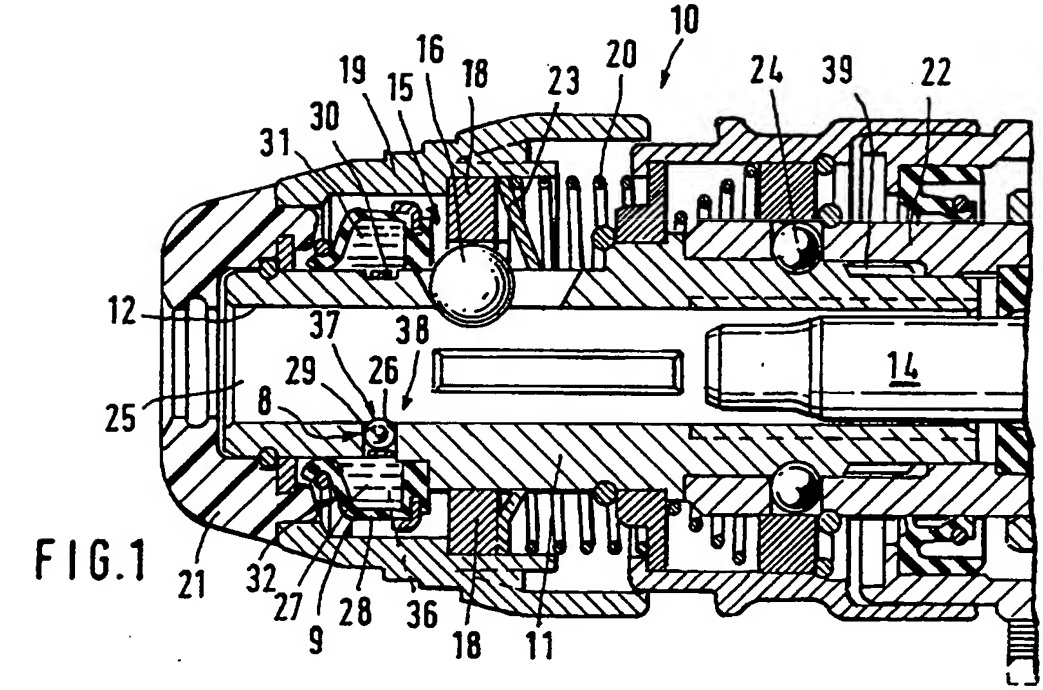
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FIG.1

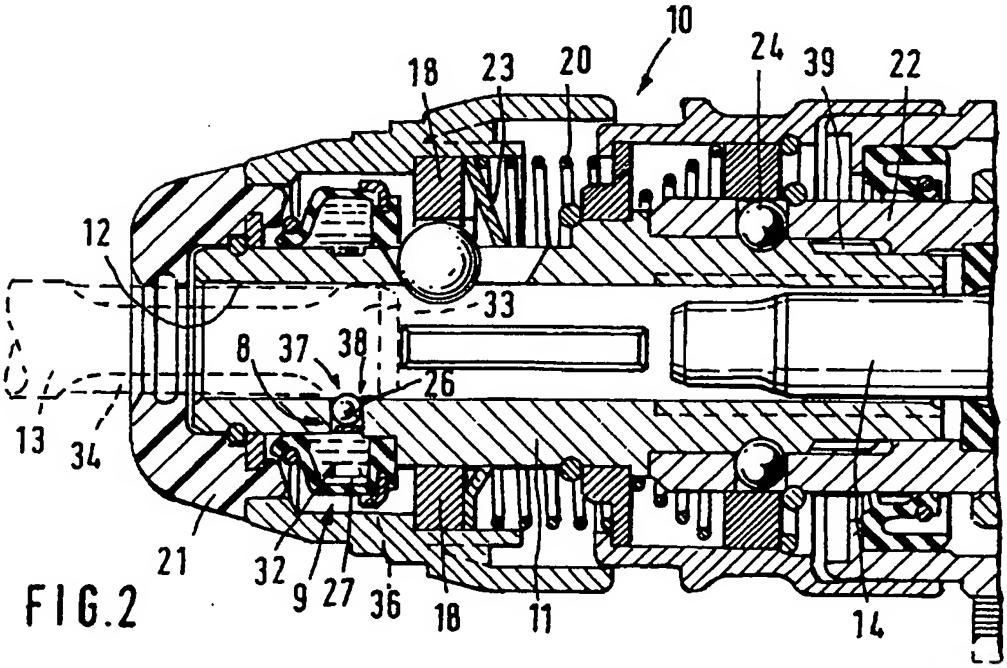
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FIG.2

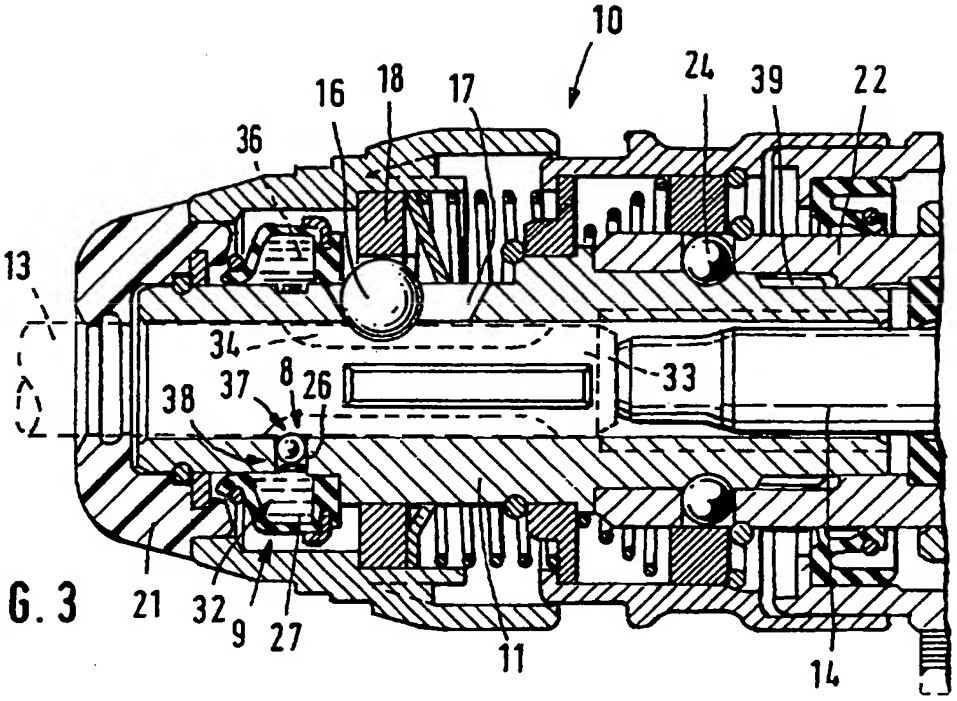
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FIG. 3

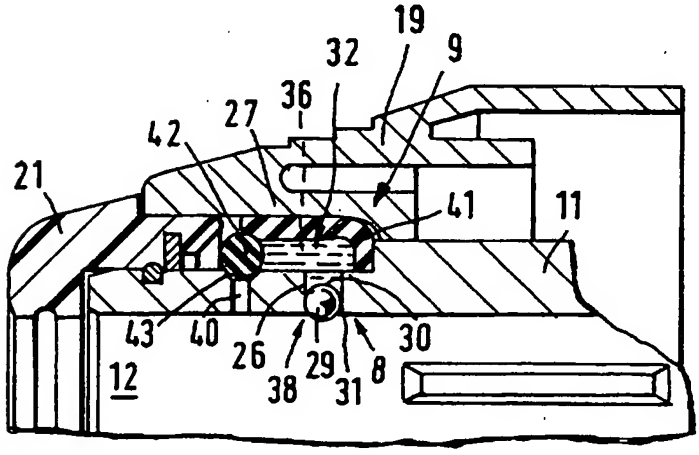
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FIG. 4

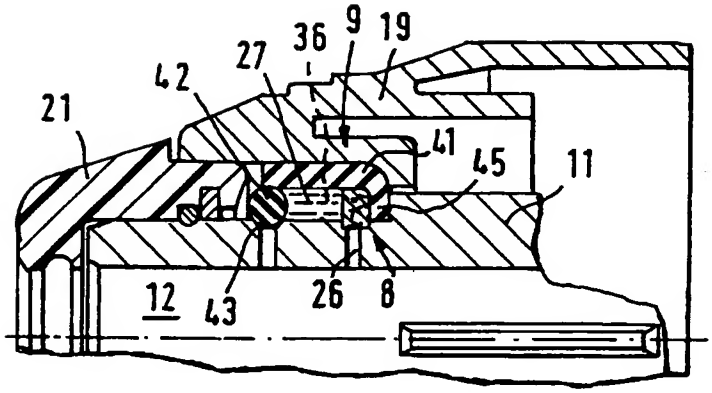

FIG. 5

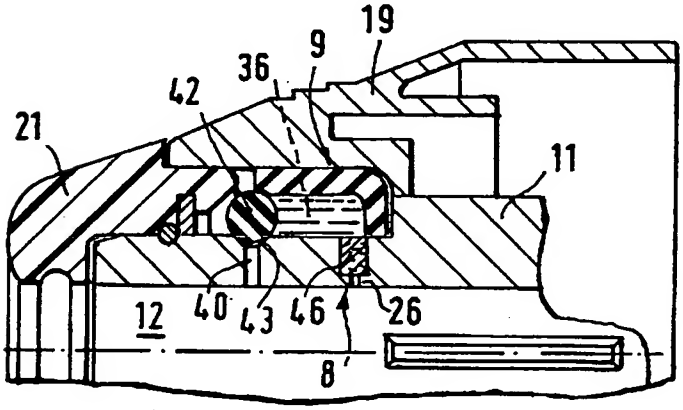

FIG. 6

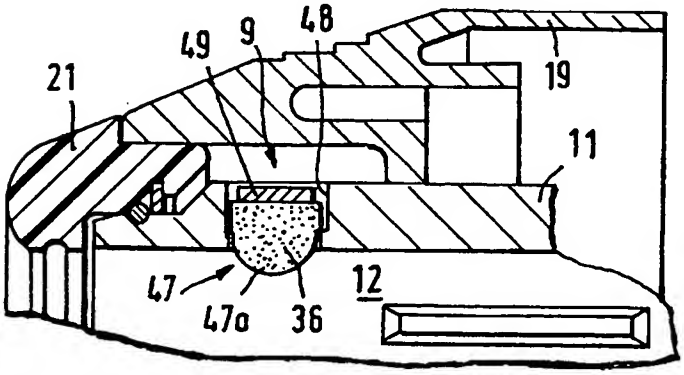

FIG. 7

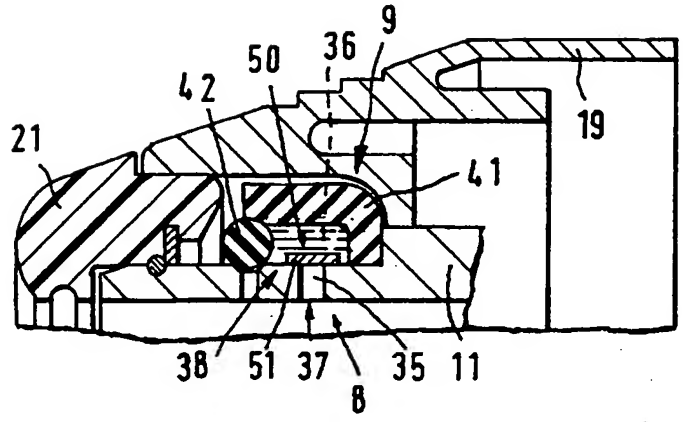

FIG.8

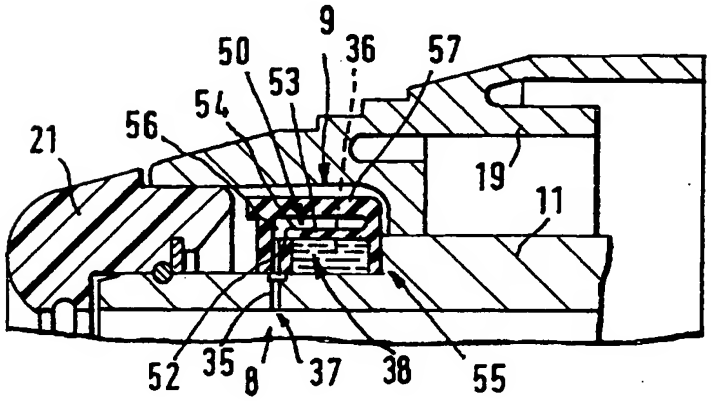

FIG.9

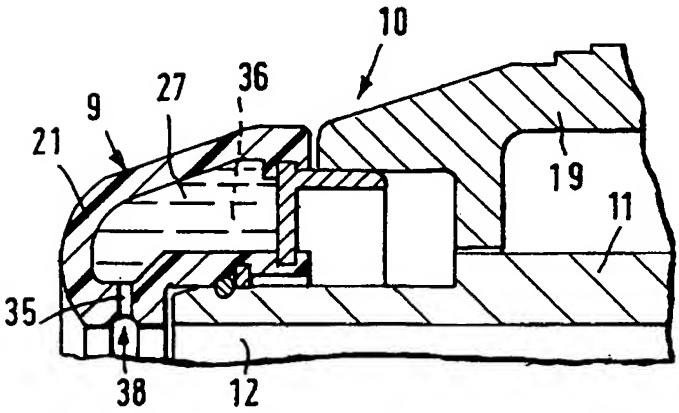

FIG.10

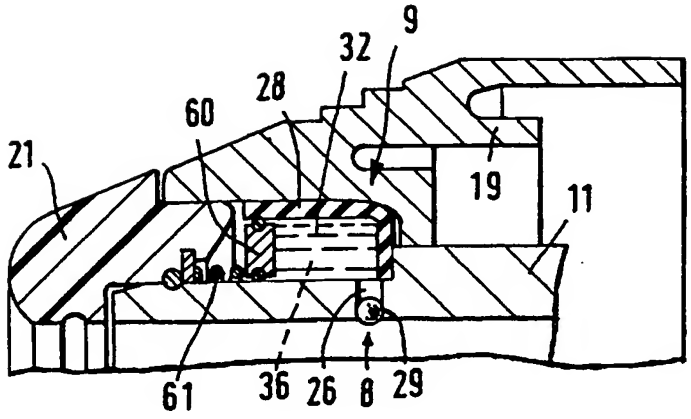

FIG.11

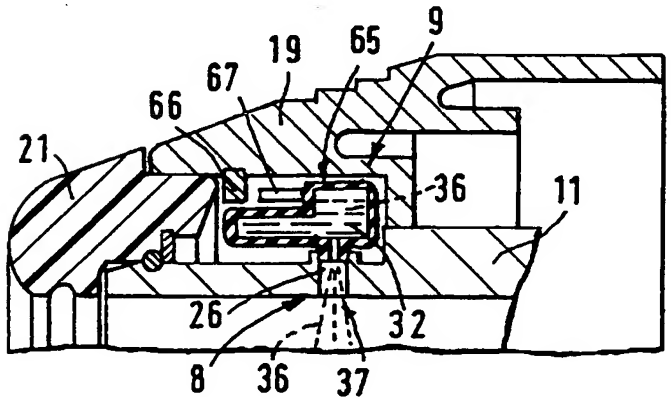

FIG.12

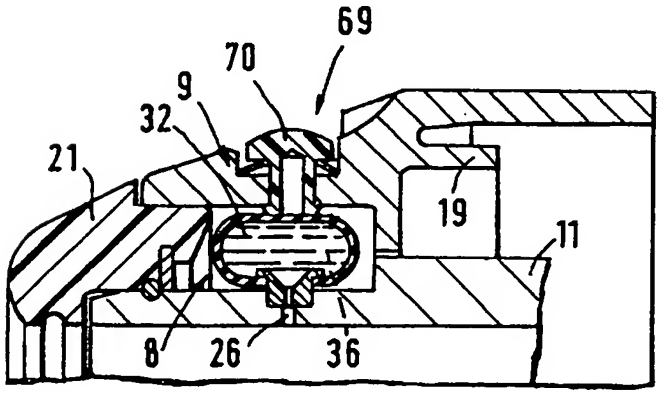

FIG.13

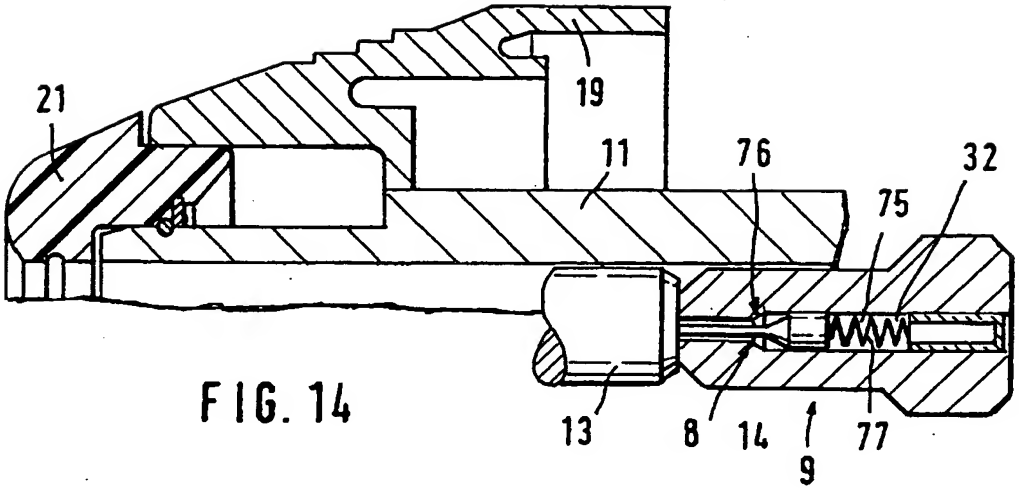

FIG. 14

Hand tool machine, in particular a drilling and/or impact hammer

The invention proceeds from a hand tool machine according to the preamble of claim 1. Such a hand tool machine is known, for example, from EP-A-494 400. The drilling hammer described there is provided with a tool holder, which is designed to receive a tool with limited axial play, in the manner known, for example, from SDS plus or SDS max holders. The tool is in said case locked through the engagement of at least one locking element into an axial retaining groove in the insertion end of the tool. An additional rotational coupling of the tool, should it be required, is effected by means of separate coupling ridges and/or likewise by means of the locking elements.

During operation of a drilling or impact hammer, both the tool and the tool holder are subject to high stress as a result of impact and torque transmission. Particularly when tools having large diameters are used, the associated high torque load leads to increased wear and hence to a shorter useful life of insertion end and tool holder.

To reduce wear, the torque-transmitting coupling faces between tool holder and insertion end have therefore in recent times been made as large as possible. The aim here is to reduce the load per unit area and hence the stress. The user is moreover recommended by indications to said effect in the operating instructions of the appliances to lubricate the insertion end of the tool prior to insertion into the tool holder. It is thereby possible effectively to reduce the friction between insertion end and tool holder, which promotes wear and is further intensified by the presence of dust particles. Furthermore, the parts subject to wear are made more wear-resistant by costly methods such as boronizing or hardening.

In practice, it has however been shown that the measures provided for reducing wear are still inadequate and/or very expensive. For instance, particularly with DIY appliances it may be supposed that lubrication of the insertion end is not effected by the operator as often as would be desirable as such. To some extent, this is probably because the use of lubricant is hardly accepted by the operator. However, the non-use of lubricant is certainly also to some extent due to the fact that the operator of the hand tool machine during use just does not have a suitable lubricant to hand.

Advantages of the invention

The hand tool machine according to the invention having the features of claim 1 has the advantage that the operator during use of the hand tool machine always has a store of lubricant available and so the non-use of lubricant is avoided. As a result of the lubricant store, regular lubrication is guaranteed and, as a result, the useful life of tool holder and tool is considerably prolonged.

Advantageous developments and improvements of the hand tool machine according to the invention are possible by virtue of the measures described in the dependent claims.

It has proved particularly advantageous to dispose the machine-side means of lubricating the insertion end in such a way that during insertion of the tool a defined forced lubrication is effected. By said means, the receiving of the tool is always effected under optimum lubricating conditions independently of the operator, thereby avoiding incorrect lubrication and increasing operating comfort.

Drawings

Various embodiments of the invention are illustrated in the drawings and described in detail below. Figures 1 to 3 show a first embodiment of a tool holder of a drilling hammer according to the invention with a tool shank in different insertion positions, and Figures 4 to 14 show diagrammatic views of different tool holders in longitudinal section, which serve as examples of further forms of construction of the invention.

Description of the embodiments

In Figure 1, 10 denotes a tool holder of a drilling hammer (not shown in detail), which comprises a receiving body 11. The receiving body 11 forms a central opening 12, into which an insertion end 33 (Figures 2 and 3) of a tool shank 13 is insertable. Projecting into the opening 12 from the machine side is an impact body 14, which in impact mode of the drilling hammer exerts axial impacts upon the tool shank 13.

The tool holder 10 is in a known manner provided with a tool locking device 15, which comprises a locking element 16 formed in the present example by a ball, which is disposed in a hole 17 in the receiving body 11 and in a locking position projects partially into the opening 12. The locking element 16 is in said case prevented from engaging entirely into the opening 12 by a suitable, e.g. conically tapering design of the lateral dimensions of the hole 17.

The locking element 16 is radially overlapped by a closing ring 18, which is axially displaceable by means of an operating sleeve 19 which embraces the receiving body 11. A spring 20 loads the closing ring 18 with an axial force in the direction of the locking position, in which the closing ring 18 radially overlaps the locking element 16. Disposed between spring 20 and closing ring 18 is a retaining

plate 23 which, during insertion of the tool shank 13, yields axially counter to the spring action. The closing ring 18 therefore has to be operated only for unlocking the tool shank 13.

The tool-side end of the receiving body 11 is in a known manner covered by a dust protection cap 21 which, once the tool shank 13 has been inserted, rests against the latter and therefore prevents drilling dust from penetrating into the opening 12. The tool holder 10 is connected to the drilling hammer positively by means of balls 24 in an axially fixed manner and by means of a tooth system 39 so as to be locked against rotation. The balls 24 engage both into the receiving body 11 and into a guide tube 22 of the drilling hammer.

A radial through-bore 26 is formed in the basic body 11 between a tool-side end 25 of the location opening 12 and the tool locking device 15. The bore 26 opens inwards into the opening 12 and outwards into a chamber 27, which is formed by a diaphragm 28 and the basic body 11. The diaphragm 28 is designed so as to extend substantially in a U-shape around the basic body. The chamber 27 forms a store 32 for a lubricant 36 and is filled with the lubricant 36 indicated by dots in the drawing.

Disposed in the bore 26 is a valve body 29 formed by a ball, which is radially overlapped by a spring ring 30 and pushed in towards the receiving opening 12 in the direction of a closed position against a valve seat 31. The valve body 29 and the valve seat 31 form a dosing valve 38 for the lubricant. In the locking position, the valve body 29 projects partially into the opening 12. At the same time, it then seals off the bore 26, which forms a connecting line between location opening 12 and chamber 27.

A mouth region of the bore 26 into the opening 12 forms a lubricant supply point 37. The chamber 27, in terms of its size, is so designed that the tool holder 10 may be provided at the manufacturer's premises with a lubricant quantity which is sufficient for a long operating period.

In Figure 2, the tool holder 10 is shown with the tool shank 13 partially inserted. For insertion of the tool shank 13, the insertion end 33 of the latter is pushed axially into the opening 12. The insertion end 33 has a slight play relative to the opening 12 so that the valve body 29, during insertion of the tool shank 13, is radially displaced and lifts off the valve seat 31. The connecting line 26 is therefore opened and lubricant passes to the lubricant supply point 37. Upon further insertion of the tool shank 13, the released quantity of lubricant is distributed in the opening 12 and on the insertion end 33.

In Figure 3, the tool shank 13 is shown inserted into the opening 12. The locking element 16 then engages positively into an axially closed locking groove 34 in the insertion end 33. The valve body 29 is then situated radially over the locking groove 34 or over a second locking groove 34, so that the valve body is pushed by the ring 30 back against the valve seat 31. Once the tool has been inserted, i.e. during operation of the drilling hammer, the lubricant supply is therefore interrupted. It is only with removal of the tool shank 13 that the connecting line 26 is opened and lubricant released once more.

Figure 4 shows a second embodiment of the invention. Identical parts and parts of an identical effect are, as in the following embodiments also, provided with identical reference numbers. Here, the store 32 is likewise accommodated radially between the receiving body 11 and the operating sleeve 19. The chamber 27 is formed by an

L-shaped packing 41 of rubber material mounted on the outside of the receiving body 11. An end face of the chamber 27 is delimited by a sealing ring 42, which is seated in an annular groove 43 at the outer periphery of the receiving body 11. A vent 40 connects annular groove 43 and opening 12. The vent 40 prevents a pressure upon the lubricant being generated after filling of the chamber 27 with lubricant and subsequent mounting of the sealing ring 42. Rather, during mounting of the sealing ring 42 a pressure compensation between atmosphere and store 32 is effected via the vent 40.

Figure 5 shows a further embodiment of the invention which differs from the second embodiment shown in Figure 4 in that, instead of the dosing valve 38 operated by the insertion end 33, a felt packing 45 is provided which covers the bore 26 between opening 12 and lubricant depot 27. The felt packing 45 is in said case so designed that a specific quantity of lubricant constantly reaches the opening 12.

Figure 6 shows a fourth embodiment in which, instead of the felt packing 45 of Figure 5, a felt wick 46 is used. The felt wick 46 is in said case seated in a recess inside the bore 26.

In the fifth embodiment illustrated in Figure 7, the store 32 is formed by a lubricating body 47, which projects partially into the opening 12. The lubricating body 47 is housed in a pocket 48 in the basic body 11 and is pushed by a spring ring 49 radially in the direction of the location opening 12. With an inner end 47a the lubricating body 47 forms an approximately hemispherically rounded portion. In said manner, it is guaranteed that a tool shank 13, which is inserted into the location opening 12, during insertion comes into contact with the lubricating body 47 and pushes the latter radially outwards, during which process lubricant 36 is

transferred from the lubricating body 47 to the insertion end 33. The inner end 47a of the lubricating body 47 projecting into the opening 12 is preferably made of a solid lubricant.

Figure 8 shows a sixth embodiment of the invention. Said embodiment differs from the embodiment according to Figure 4 in that, instead of the dosing valve 38, a temperature-dependent diaphragm gland 50 is used. A connecting line 35 is covered by an annular skinplate 51 made of a material which is subject to thermal expansion as the temperature rises. Given rising temperature values of the kind caused in particular by poor lubricating conditions during operation of the drilling hammer, the temperature-dependent thermal expansion leads to the formation between the skinplate 51 and the receiving body 11 of a gap which triggers the transport of lubricant from the store 32 to the lubricant supply point 37.

Figure 9 shows a further embodiment, in which a speed-dependent lubricating device 55 is provided. An L-shaped internal sealing diaphragm 53 forms together with a sealing collar 52 on the outer periphery of the receiving sleeve 11 the chamber 27, in which the lubricant store 36 is situated. The sealing diaphragm 53 lies with one free end 54 on the sealing collar 52. As soon as the receiving body 11 is set in rotation, a centrifugal force acts in a radially outward direction upon the sealing diaphragm 53 so that a gap may form between the free end 54 and the sealing collar 55, allowing lubricant to pass out of the chamber 27 into an annular chamber 56. The annular chamber 56 is delimited in an outward direction by a second diaphragm 57 and connected by a connecting line 35 to the lubricant supply point 37. The lubricant 36 leaving the chamber 27 collects in the annular chamber 56 and is then conveyed through the connecting line 35 to the supply point 37.

Figure 10 shows a further embodiment, in which the store 32 for the lubricant 36 is accommodated in a cavity of the dust protection cap 21. The lubricant 36 in said case passes through the connecting line 35 into a region situated in front of the location opening 12. The connecting line 35 may, as in the previous embodiments, be provided with and/or sealed by a dosing apparatus.

Figure 11 shows a form of construction of the invention, in which the store 32 is formed, as in previously described constructions, by an L-shaped diaphragm 28. The open end face of the diaphragm 28 is in said case delimited by a piston 60, which is disposed in an axially displaceable manner at the outer periphery of the receiving body 11. A spring 61 loads the piston 60 in such a way that it exerts a pressure upon the lubricant in the store 32. The valve body 29 is in said case, in the manner described for example also with reference to Fig. 1, disposed in a bore 26 and pushed outwards during insertion of the tool shank. After insertion, the piston via the lubricant exerts upon the valve body 29 a restoring force in the direction of the latter's valve closing position. A spring ring is therefore not required.

In Figure 12, as a means of lubricating the tool shank, an oil atomizer 65 is provided which is triggered upon a displacement movement of the operating sleeve 19. To said end, the operating sleeve is provided with a stop 66, which cooperates with a plunger 67 of the atomizer 65. The plunger 67 upon a displacement of the operating sleeve 19 causes a build-up in the atomizer of a pressure which results in a release of lubricant through the bore 26 to the supply point 37. Given a rotatable operating sleeve, the plunger 67 would have to operate correspondingly in a peripheral direction.

In Figure 13, a pressure-operated atomizer 69 for lubricating the tool shank is provided as a lubricating means, which is actuable manually by the operator via a pushbutton 70. By means of the pushbutton 70 a pressure resulting in the release of lubricant may be built up in the store 32, which is of a bellows-like design.

In Figure 14, the means of lubricating the tool shank 13 are housed inside the drilling hammer in the impact body 14. The impact body 14 has a central through-opening 75, in which a plug valve 76 is housed. The plug valve 76 is loaded in the direction of its closing position by a closing spring 77. As a result of the reciprocating motion of the impact body 14 the plug valve 76 opens and closes periodically, thereby allowing lubricant to pass to the tool shank 12. The supply of lubricant is in said case effected from the lubricant store of the impact mechanism. The lubricant store may however be disposed alternatively inside the impact body 14.

A common feature of all of the embodiments is that in each case means 9 of lubricating the tool shank 13 inserted or to be inserted into the opening 12 are provided, said lubricating means 9 comprising at least one store 32 for storing lubricant. The lubricant supply is quantitatively controlled by dosing means 8. The term, dosing means 8, includes both means for a continuous lubrication and means which provide an interruption of lubrication after lubrication has been effected.

The supplied quantity of lubricant has to be dosed in a way which prevents an escape of lubricant from the opening 12. The lubricant store is in said case to be designed as far as possible in such a way that a filling by the manufacturer is sufficient for the total life of the hand tool machine. It is in principle possible also to provide a refill facility. In the embodiments with a dosing valve, topping-up

may easily be effected through the opening 12, e.g. with the aid of an angled syringe by placing it in position on the valve body.

Claims

1. Hand tool machine, in particular a drilling or impact hammer, having a tool holder, which comprises a receiving body forming an opening for receiving an insertion end of a tool shank, characterized in that the hand tool machine is provided with means of lubricating the tool shank inserted or to be inserted into the opening, said lubricating means comprising at least one store for storing lubricant.

2. Hand tool machine according to claim 1, characterized in that the store is disposed outside of the opening.

3. Hand tool machine according to claim 2, characterized in that the store is disposed between the receiving body and an operating sleeve surrounding the receiving body.

4. Hand tool machine according to claim 2, characterized in that the store is disposed in a chamber inside a dust protection cap at the tool-side end of the tool holder.

5. Hand tool machine according to one of claims 1 to 4, characterized in that provided between the store and the opening is at least one connecting line, which opens into the opening and in the region of its mouth forms a lubricant supply point.

6. Hand tool machine according to claim 5, characterized in that the connecting line is disposed in such a way that the insertion end of the tool

shank during insertion into the location opening is to be provided with lubricant.

7. Hand tool machine according to claim 5 or 6, characterized in that the lubricant transport through the connecting line is dosable by means of at least one dosing means.

8. Hand tool machine according to claim 7, characterized in that the at least one dosing means at least once the tool shank has been inserted enables an uninterrupted lubricant supply.

9. Hand tool machine according to claim 8, characterized in that the at least one dosing means is formed by a defined cross section of flow.

10. Hand tool machine according to claim 9, characterized in that the connecting line is provided with a felt packing or a felt wick.

11. Hand tool machine according to claim 7, characterized in that an interruption of the lubricant supply may be effected by means of the at least one dosing means.

12. Hand tool machine according to claim 11, characterized in that a valve is provided as dosing means.

13. Hand tool machine according to claim 12, characterized in that the valve comprises a valve body, which projects at least partially into the opening and during insertion of the tool shank is adjustable in the sense of a valve opening.

14. Hand tool machine according to claim 13, characterized in that the valve body is disposed in a radial bore in the receiving body and held in its closing position by a spring ring, the valve body, once the tool shank has been inserted, engaging into a locking groove disposed therein.

15. Hand tool machine according to claim 11, characterized in that a valve which closes and opens in a temperature-dependent manner is used as dosing means.

16. Hand tool machine according to claim 11, characterized in that a valve which closes and opens in a speed-dependent manner is provided as dosing means.

17. Hand tool machine according to claim 11, characterized in that an atomizer actuable by the operator is provided in the tool holder.

18. Hand tool machine according to claim 1, characterized in that the store is disposed at least partially inside the opening.

19. Hand tool machine according to claim 18, characterized in that the store is formed by a lubricating body, which projects into the opening and upon contact with the tool shank during insertion of the tool shank releases lubricant.

20. Hand tool machine according to claim 18, characterized in that the store is disposed in an impact body of the hand tool machine.

21. A hand tool machine substantially as herein described with reference to Figures 1 to 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13 or 14.

The Patent Office

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INVESTOR IN PEOPLE

Application No: GB 9901595.0 **Examiner:** Dave Butters
Claims searched: 1-21 **Date of search:** 23 March 1999

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.Q): B3B, B4C

Int Cl (Ed.6): B23B, B25D

Other: Online: WPI

Documents considered to be relevant:

Category	Identity of document and relevant passage	Relevant to claims
A	US 5199833 A (BOSCH)	
A	US 3797584 A (BAILLEY)	

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.